Menlo Park Notebook #104 [N-80-07-05]

This notebook covers the period July 1880-February 1881. All of the entries are by Francis Jehl except for one drawing by Edison of a lamp with a spark gauge. Included are notes, calculations, and drawings of lamp and vacuum pump experiments; notes on motor and dynamo experiments; and notes and calculations about meter experiments. There are also notes and calculations relating to battery tests, resistance tests for wire and electric railroad track, tests of copper wire, and tests of insulation compounds. The label on the front cover is marked "Francis Jehl" and "1880." An index has been pasted onto the inside front cover. The book contains 284 numbered pages.

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July 5 1880

Exp. 1.

Made a very diluted solution of Rice and

Richardson's paper

the being

look at it, I found the

it was broken down

dont know, I noticed

that one of the clamps

was black. I put it

next Carbon in a

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LIBRARY OF THE

BOARD OF PATENT CONTROL,

120 BROADWAY, NEW YORK.

From Library
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July 5 1880

1

Exp. 1.

Made a very diluted solution of Prussic acid got six ounces of Bichromate battery. Made to take two carbon clamps & put the battery on to it, (2 being put in the solution.

In the evening I went to look at it, I found that it was broken how I dont know, I noticed that one of the clamps was black. I put a new carbon in a

[illegible]

In the morning (July 6)

I looked at it again and

there was a thin deposit

~~on the~~ on one of the strips

(the fine end).

made a diluted solution

of Copper Sulphate +

took a carbon in clamps

and put it into it, and

put one cup of Daniells

on it. Let it working

all night and in the

morning there was a

deposition the carbon.

as shown in the

figure.

SKH July 6 1880

had some good and clean
[illegible] which I cleaned the
day before by passing it through
some dilute acid by means of
the [illegible] fountain pump
(we use for) then a
spherical pump made that
covered the vessel of acid
with a spiral lamp (the fall
tube from the gauge so
as to have the lamp and
gauge in one piece, and
to Electro weld the
low much the gauge
would fall, while the

Camp was burning.

I put in one of the
~~[illegible]~~ lamps, specifyy as the
"Monkey grass." lamp just
fifteen minutes passed one
and at twenty minutes to
three it was ready to be
sealed from the fall tube
called Mr Edison and
on coming back found the
lamp busted. I then immediately put on another lamp
this time one of the regulars
and at five it was ready
to be sealed off from the
fall Tube. after
being sealed it was

watched by Mr Edison
and himself and the
vacuum fell from one
which was very good
being about an inch & 1/2 long
before started to one which
was very hard being way
down in the wide tube
of the gauge.

ON 5 July 7 1880

Got a pump made which
could easily be sealed
off from the gauge as
before, the lamp being
sealed direct to the time
to the pump, no stopper used
commenced half past
eleven ~~twelve~~, heated the lamp
at about five minutes
to twelve, kept pump running
all through noon, got no
very high vacuum, was good
after dinner heated
it up again and

at about two o'clock
we pumped it off &
did not all this [illegible]
[illegible] for
of air falling in. then
we left it till four
o'clock & then we tried
it again & it was about
one inch and a half
from the top. tested it
again at six o'clock
and it went down
about three quarters of an
inch.

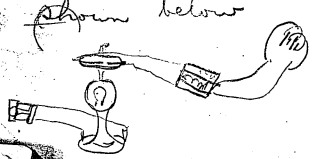
~~Lathe Hadar~~

~~Had a pump made to
the~~

Had a lamp made in
the afternoon by Bohm which
was on top of a spirit gauge
like this . In the evening
we exhausted it, commencing
at eight and ending
at ten. The lamp was
heated for about an hour

July 8 1880

had the induction coil fixed up, two cells in multiple arc, gave a spark about two and a half inches in length. then put it on the lamp (or rather on the spark coil above the lamp) being fixed as shown below



then I moved the two points together of the induction coil to see which was the smallest resistance the gauge or the air. The gauge seemed to be it, showing that the vacuum was not so very good, because it allowed the current to pass through it, it gave that blue (~~light~~ sky blue) phosphorescence on the outside end of the induction coil, and on the other end it was very slight ~~green~~ green. (Just at the end)

Boat
1. Paper
2. Palm Leaf
3. Rice Straw
4. Bamboo

7/1000

July 8 1880

(Tested the aneroids that was crossed the day before yesterday with the other that is ~~[illegible]~~ on wound around it. It looked all right, Fourteen hundredths being the res.)

Got another pump put up at about half past eleven and fitted a gauge on to it, and at twelve sealed it off; then put it on the spirit coil; and showed a proper vacuum; it must have had a crack in it

Put a Bass fiber 6 in long, 12 + 12 5/64 on the end of 20 m post Put it on at one Lockock about three before they were through using the Darlwood 8.

Put the current on, it had a bad spot on it near the clamps,

3/64
32 32

6290
6290
12580 2
3
37770
12
2mot 4970
2

Test of Lamp
Bass fiber 6 in long
Res cold & 310

20 cells = 32 Def.
C. 1722
E.M.F. 217.
Def on Lamp ~~[illegible] 70~~ 70
Def on Res 70.2 ohm ~~175~~ 184

16C
~~Def on Lamp~~ 65 175
Def on R 175
Em F. 206

8) 206 26
68
23
136

70.2

175 : 65 : x : 70.2 1375

175
70.2
350

65

1325

Res 204R 65) 13285 (204R
130
0255
260

137
137 4

137
137 4
959 2
411
137
18769 22 2
4413
563071 3
75076
75076 2
8314667

204) 83466.7 (24
2886

Res. 210
204) 83166.
816
1566
1428
1386
1224
8

4076
204 2
16304
8152
304

4076
204 2
16304
8152
831504

154 : 70 : x : 70.2

154
70.2 2 5.
308
1288

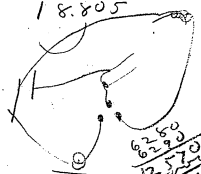
70 316

70) 13916.8 (184
591

6290
6290
12620
2285
18.805

12

1600
1000
800
800
4200
162
700
600
60
3100
32
6300



6290
6290
12580
1758

Put on at K.12 at
44 C. Def 242 = 162

14000
12620
1380

12620
1400
24020
7050

175570
175.

1000
460

Lamp was extinguished
with night. while
Loading & there seemed
to be a little blue.
Ran while could 2320 lbs
when at 16 C. El was 1470 lbs
Def on El Wt. 2/80
20 cell = 32

60
1200
1000

147 2 120
341
147 1 120 120
524
2 147 2
58 1
147 6
1323 147
2 14
2.284
99

120
120
2400
120
1440
4.3
4320
7600
5600
6 8 7 9 2 0.0
5 8 8 7
499
644
1580

1000
1500
1323
157

43

105

14000
12620
1380

6280
6290
6250
6250
9000
9000

6280
6290
6250
6250
25070
4400
29470

24) 34970 (174
24
149
140
97
80

204) 29470 (147
204
947
816
1470
1470
0

2 2

147) 6379200 (4339.
588
499
441
582
441
1410
1323

63200
6

was put on at 11.20
at 44C slept at twelve
was put on at 44C
at 8.57 went up at
nine o'clock.

July 9th 1880

Large Carbon

Lamp 134 v. Lock Glass.

commenced at 9.40

[illegible]

Total [illegible] Cold

it was 275 ohms.

6

6240
6260
6260
6250
6290
3540

1½

2172
207
2419
207

204) 34870 (174
[illegible]
140
86 21
20
69
[illegible]

3/207
[illegible]
69
[illegible]

[illegible]

Cold 275 ohms

when hot at 16

it was 174 ohms.

Em 7. 207 - ~~212 = [illegible]~~ 9½

1385

138
138
1104
414
138
19044
4413
7132
7176
76176

174 | 4436492 (4848. pl 60
696
1476
1392
844
696
1489
1396
93

4848/53000

173
173/56

put at 41°C at 8 o'clock
it was slightly blue
in the [illegible], went up
at 3.05

7010

29

6290

2 | 140200

7010

Beaudoin 1248

was put on at 3.20
and at six took it off
after supper I wanted
to test it and I found
it was broken at the
clamps.

July 10 1880

No. 1249 Palmetto fiber

Had it exhausted [illegible] the morning. Res when cooled 453 ohms,

152 U
152

3.

3304
7604 3411) 33000 (9.6 per
152 30699
23104 2301 hour
4413
69912
92416
93716

300) 1023597.2 (3411 — 3411 ft lb
9 [illegible]
1 [illegible]
12 [illegible]
3 [illegible]
3 [illegible]
5 [illegible]
2 [illegible]
— 7

~~No. 1253. Bamboo of the Tip of a fan~~

At 14 C. E. M. F. 227-225

Def on Res. 253 Res. 70.2
Def on Lamp. 59 300 hot

253 : 59 :: x : 70.2

253
70.2
506
1771

59) 17706.06 (300.
177
60

3/227
75

3/227
76
152

2 225
75

No 1253 Banco from
the top of a tow-
20 65
Rec when Cpl 188 R

17 C. E. M 7.298

8.6

3

99) 434184. (43
396
881

114) 434154. (3808
342
972
3 3
1 3
0984
972
72

6290
6280
6260
4100

200) 22938 (114 hot
20
29
28
98
80
13

$V^2 \times 443$
R

3 | 298 2
99

99
99
891
891
9801
443
3.

3808 99 7
3046479 2

29403
8204
3902 04
2

99) 3841843 (4333
396
881
881
2970
2970
8148
792
564

3808.) 33000
30464
2536 0
2656
5
6

1259. Paper
bustard on the pump,
there was a very bad
smell near one of the clamps.

Sunday July 11 1880

Went and made the clay
of my twenty cells = 216 clay
and then left it, to renew
them again

Cells renewed I gave
241 - 244.

10/240 (2 p 0

July 12 1880

Twelve feet of Bemis Lamp. No. 1253 burning at 16 cts

287.2 [illegible] 380

2600

6290

[illegible]

[illegible]

3 [illegible]

288
3
2599
3|299
99

20|22 6 0|113
20
26
20
60
55

113.|4 34 184 (38422 ft lbs
339
951
904
478
452
264
226

(42) 30 min (8.5 ft

22640
210

put on at 10:10 a.m. at 44 C. . 815 d.

after being ~~[illegible]~~ burning 30 m I took off the C to read the clip on the pump. put on again at 44 C at 10.48 stop again at 11.28. put it on again at 11.30 it broke at 11.35

30 m
45
75

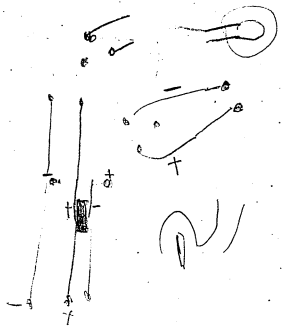
12
28
5
45

have burned a total of 75 m at 44 C.

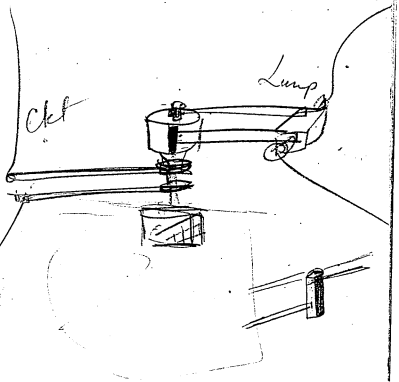
July 12 1880

1250 Palmetto :

Very bad spot work and scaled it off.



Corning Glass, Lamp with Spark gauge, No 1251



$$E = \frac{C}{R}$$

$$R = CE$$

$$\cancel{E = \frac{C}{R}}$$

$$C = \frac{E}{R}$$

$$CR = E$$

$$R = \frac{E}{C}$$

Took a little motor (electric motor) the three armature one with four [illegible] two on one side and ~~the~~ two on the other, something as shown in the figure

then made an armature so that the current could be reversed, something as show in the figure below. Did had it on the motor so that it would revolve with it.

had a lamp on and it always the current fell straight, but when the lamp burned it jumpt across the armature and burned it a little

.1237

Bass clamped very slight

273
3
819
273
49

273
1.366
1638
1638
819
273

273) 372.918 (1

$$V = \frac{273 \times V}{273 + V}$$

$$V = \frac{273 \times V}{273 + V}$$

$$V = \frac{273 \times V}{273 + V}$$

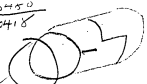
$$V = \frac{RV}{760}$$

380
760
20
60

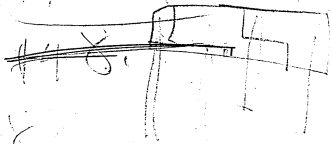
200 ~~2 800 lb~~
14

100 : 108 :: 60 : X

1080
100 | 64800
648



1080 100 : 108



18

St. Francois Beaurepaire

Francois Beaurepaire

St. Francois Beaurepaire

Friedrichner Franklin

Boston Review

Fortnightly Review

Review

Review

July 26 1880

Lamp that was put in Kerosene
Lamp put up at 9.37
at 120 C and burned at
10.1
Volts when hot at
this candle power

254
250
2504
20/252 = 12.5
52
40
12

1,08 64

4/252
63

4/252
63
2

108
64
432
648
100/6912
69.12

100:1.08::64:X

Testing April 18 1880 Standard cells.

Cells	R	L
Box 1	254	250.5
2	254	250
3	251 / 253	247 / 250
4	244 / 254	240 / 250
5	253	248 / 250

100:1.08::X:3

~~100:1.08::3:1~~

108
324
32

100:108::

Aug 18

Testing that small piece of Railroad track.

Res of Wire 3.65. ~~[illegible] 3.85~~

Res of the track 4250 ohms

Tested at with bridge and with Thompson's Quart Res Tel.

Aug 18 1880

Testing the 25 wire cable

Tested 13.9 ohms Here

Must be a cross somewhere

10

33)130 (4.
132
2
21.0
7 6.1

Aug. 19 1888

10.2/3 3)16

70)14000
2000

10.7/3

32

50)200
4
50.1

3)48
16

21.6
9
864

420

64)270.0(4.22
128
140
128

21.6
4.2
432
864
90.72

1600
3200
6800

1260.0
1400

12600
1400

12600
1400
70.)14000
2000

70)1400.0(20.0

12000
1400
26000
1400

Aug. 19 1888

Lamp No. 1458

8 X 16

Res. Cold 329 ohms

10.7/3 C

Cur R.208 L.208

37.660
5000
200

Res. 143160
215 ohms

Cur R.2438 L. 2.39
2.39
32 C

20 call 32 R
" " 33.4
2)65
33

37.660
100
200

Aug 19

33 | 2080 (6.3
198
100
2080
69
138

21.6
6.3
648
1296
136.08

136.08

10.66 ©

10.66 © 1.36 ✓ 3/5
136
816
408
36
18496
443 32
5488
73984
73984

37660
5000
200 | 43160 (210.0 ans
400
316
160
10.66
64
4264
8528
89544 © Ans K.P.

ans 211 | 19372.8 (3883. ft lbs
633 × 7
1863
1686
1770
1686
692
633

3883 | 3300000 (8.4 HP
31064
19360

10.66 ©
Rs 210 ans
ft lbs 3883.
per H.P 8.14

33/231 2

243
239
2482 2
33 | 2410 (7.3
231
100

21.6 all
7.3
648
151
157.68

157 ✓

157 | 4
157
099
785
157 | 3
54 2
24649
443
73947
9856
9856
188 | 6564 | 507 | 3467 ft lbs
564
879
752
1275
1128
1470
1316
1.54

81/162 2241 89 10

37.660
100
200 | 37760 (188.8 Rs
200
7760
1600
1760
16

32 ©

3467
7
24269
34
34
3467 6

157
157
1099
785
157
24649
443
739947
98596
98596

188 | 109195 (580.8 Ohms
940
1519
1504
580.8
1550
1504
46

580.8 | 33080.0 (5.6 Ohms
29040
29600
34848
4752

145 | 145
5 | 6
1345 | 125
6 | 5

168 | 168
5 | 5
1216 | 6
1204

x

$\frac{x-10}{10} =$

$\frac{x}{4} - 10 = \frac{x-10}{10}$

~~$x = 40$~~

$10x - 400 = 4x - 40$

$6x = 360$

$x = 60$

580.8
2040
4

$\frac{x-20}{12}$

$\frac{x-20}{12} = \frac{x}{6} - 20$

$32x - 20 = 2x - 40$

580.8 Ohms
Res 188 ohms
5.6 Watts.

16
8
128

144 | 165
165
720
864
144

128 | 23760 (184 Ohms
128
1096
1024
720

223 | 10000 (
~~87+45~~
45

45 | 2250 (
2250

and 19 meter

no		
1	.107 has	R 45
	.11	L 43
2	.02	R 40
	.03	L 182
3	.0219	R 48
	.03	L 179
4	.02	R 55
	.03	L 165
5	.0284	R 55
	.03	L 150

227

222 | 100 (

.45
115
345
345
0.45

160

.4
85
340

Aug 20 1880 55.2

Meter Res.

No 1 Res .106

R 45
L 43
88

45
88)150 (1.4
88
220
180
40

45
1.4
180
45
63.0

Diameter
.017
.011
.011
.011
.011

No Brush	Res	Di	Lgth mm	Meter Shunts German Silver
1	~~.0160~~	.011	583 mm	6 mm
2	.0216	.011	437 mm	25 mm
3	.0219	.011	436 mm	25.5 mm
4	.0222	.011	608 mm	35 mm
5	.0234	.010	610 mm	35 mm

~~No 1 Res .106 Di .011 Length 583 mm~~
~~2 .0216 " .11 " 437~~
~~3 .0219 " .11 " 436 "~~
~~4 .0222 " .11 " 608~~
~~5 " .0234 " .10 " 610 mm~~

125
125
625
250
125
15625
443
46875
62500
62500

195 | 6921875 (3549. ft
585
1321
975
966
780
188
175
132

3549 | 33000 (9.0
31941
1059.

3549
8
31941
44

3549
8
941
16

Aug 20 188

1457. 8+16 (from Gauge)

· Cold 30 ohms

10.66 C

E in 7,197 8 | R 37.650 / 1500 / 200 / 195 ohms
190 R.

37.650
1.500
200 | 39.150 (195
1915
1850
1110
1000

31
36
2 | 67
33

1250

197
190
2 | 387
33 | 183 (5.5
165
280
264
16

246
5.5
1728
1080
1252.8

Resistance 37
10.66 C
Res 195 ohms
1250
ft lbs 3549
9. H.P

110 × 110 = 12100

159 × 2736 = 435039.0

2736 × 33 = 90288

Cold Res 262
Hot 159 ohms
110 V
2736 ohms
12 H.P.

Aug 20 1880
Lamp. 1452

(note from Book book) Bamboo carbon by Crane Bros in the old factory Jewitt 8/1000 by 16/1000 Aug 18 1880. genuine $2.00, edge warp

~~10.66 candles~~

Cold 262 ohms

Ell. 7. L. 173
R. 16.6

173 × 166 = 28718

33) 1339 (40.6
132
165
40

Res 37650
6290
31360

~~6200~~

37650 − 6290 + 500

200

31360 × 500 = 15680000

200) 15680000 (78400

Batteries 159 ohms
R 31 11.0 V
L 36 33 20.6
67
516
1080
110.016

339	7.5302
67	8.1739
21.6	1.3345
	2.0386
109.3 Volts	2.0386
	1.6464
159	7.7986
	3.5222

3300

10 for H.P.

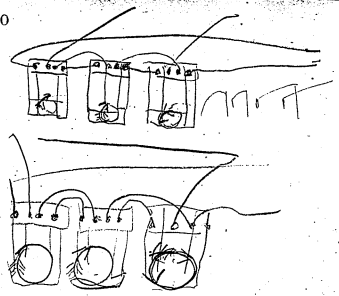
Aug 21 1880

Inside some of the cables found one wire dead 2g and 18 wire sections of [illegible] inside at about 11 ohms resist. The big b. is a lamp post dead cross allow [illegible] 2145 ohms [illegible] 1085 [illegible] cable [illegible] with muslin [illegible] with nylon [illegible] with [illegible] coal tar [illegible] with [illegible] tar, [illegible]

Aug 23 1880

Carmans Point 25. 18. 11 and [illegible] sections in all other [illegible] between wires 15 ohms

Gymna 3 ohms [illegible]



Aug 25

Fixed up the machines in the dynamo room, three batteries in series.

Also made small testing batteries, gauges & rheostats.

Aug 25 1875

The machines operated very badly last night (Aug 24) In the morning I tested all the lines, & found that the cross wire in the locomotive line lies between the wires & cut. Was 2.4 ohms

Aug 26 1880

(Land showers yesterday) Commons current 25 & 18 wire resistance between wires 31000 ohms ground 1250 & 1435 ohms

Aug 26 25.18.11 & Turnpike sections in circuit.
Between wires 13.6 ohms
Ground 37.7 & 37.5

Aug 26 1880

Lamps with nickel clamp

12 by 12.

No 1463. 1464. 1465 —

21.6
5.4
8.64
172.8
181.44.

Ballast $\frac{31}{2}$ = 31.5

Inf. 2.45

31.5 (26.50 (8.4
2520
1300
245

180 ✓.

No 1463.

Aug 26 '88

Put this on Photometer.

At 50 candles one clamp shews a blue flame inside the loop as if it were caused by joint of platinum and metal also that clamp blackened slightly

At 32 candles same only weaker

At 16 candles it did not show it

Other clamp clean and bright.

E. M. F. Det 260

Lamp 1464 =

Aug 26 '88

On Photometer

at 48 candles showed a little blue on same clamp filling only space

x like 1463.

at 18 candles it showed more and on outside of clamp also

put on at 48 candles again and it showed blue very strong —

Lamp 1464

On Photometer

At 7 candles showed no blue

at 21 candles showed blue outside and inside clamp

at 48 very strong blue

All the lamps were put on at 48 of 12.55. 1464. Lamp

Volts 4.10

Aug 26 1880

Lamp with nickel clamp

12 & 12.

No 1463. 1464. 1465

21.6
8.4
8.64
172.8
18144.

Rating 31/2 = 31.5

Inf. 225

31.5 (2650/2520 4/7
1300
1260

1805,

No 1463,

Aug 26 188

Put this on Photometer

at 50 candles on clamp shews a blue flame inside its loop as if it were caused by joint of Platinum and metal alas that clamp blackened slightly

at 35 candles same only weaker

at 16 candles it did not show it

Other clamp clean and bright.

E. H. T. Put 2600

Aug 26 188

Lamp 1464 =

On Photometer

at 48 candles showed a little blue on same clamp filling only space

× like 1463.

at 18 candles it showed more and on outside of clamp alas -

put on at 48 candles again and it showed blue very strong —

Lamp 1464

On Photometer

At ~~48~~ 7 candles showed no blue

at 21 candles showed blue outside and inside clamp

at 48 very strong blue

All the lamps were put on at 48 at 12.55. 1464 Lamp broke at 4.10

Aug. 26 1880

List of Standard Battery Rs 0.4 [illegible]

Battery 1	L 236.5	R 239	
" 2	L 235.	R 237.5	
" 3	L 237	R 239	
" 4	L 238	R 237	
" 5	L 237	R 239	

Aug. [illegible]

[illegible] Sand 1484 [illegible]
[illegible] grams [illegible]
[illegible]

169) 1500 (1.8
169
1610
[illegible]
300

150) 245 (1.
150
1150
242

169) 303 (2
[illegible]

150) 280 (1.8
[illegible]

2.84
2.8
2265
282

150) 282 (1
150
1320

1.2
280

21.6
1.2
1728
2.16
3888

Aug 27 1880

Comparing Bi-Chromate battery (a minus pole) with the standard battery

Standard cells	R	L	Battery cells	R	L
1 cells	169	168.5	1	319.5	322.5
4	87	88	4	163	164
4	169	158	4	297.5	294
~~[illegible]~~			4 cells	303	300
					300
20	150	150	20 C	284	281

284
1.61
3 mo 1.65
1.88
1.04

1.85
1.08
1404
188
2028 4

21.6
1.08
1728
216
6 2
21.6
1.8
1728
216
21.6
1.8
1728
216
38.88

Aug 27 1880
Rmall [illegible] R.R.
Rec. 8390 [illegible]

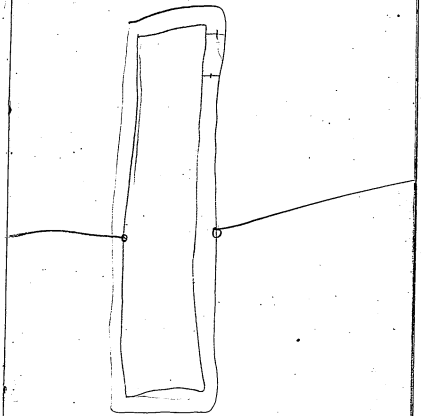
Aug 27 1880

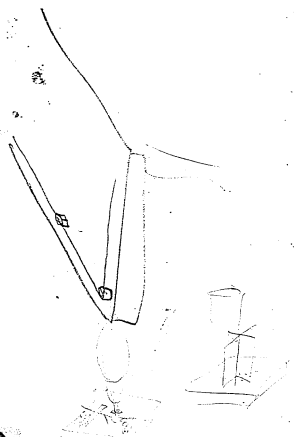
Gum Benzoin
Oil spruce
Oxalic Acid

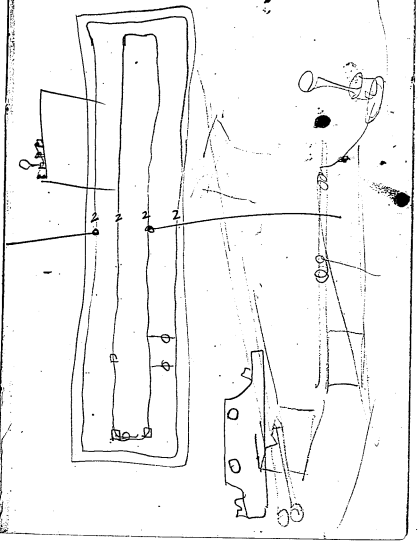
Lungstalk Ammonia
Gum Benzoin
Oil Spruce
Acid Oxalic

Gum Amber
Benzoin Copal
Anilin Oil
Oil succin
Carbolic Acid
Creosote.

Benzoin Copal
Gum Camphor
Oil spruce






Z
Z
Z
Z

Aug 28 1880

Ex 1.

Put a lamp in the bridge and balanced it, then forced it to see if it would deflect its resistance, but the gal did not move also tried a little heat with a lamp but did not act as a rod, had five cells

Aug 29 1880

The last one made of the spiders, showed a poor vacuum the spark did not jump outside there was a light pink phosphorescence and the glass had a green phosphorescence

One of the spiders made some time ago, its phosphorescence was much brighter, showed a poorer vacuum than the one above.

No 3 showed a poor vacuum

first of cable made by How Ill. was put in water and tested 54 ohms

another, EOIL OF. was without insulation ~~tested~~ 127 with 2.B

Insulated cable | I lifted the Pt plate up and it went up to 60 ohms.

Aug 31 1880

Test the bare wire by Q Wheatstone:

R'' = 1001

R = 1000

D of 226 + R'' + R

S = 100 ohm

Cable Insulated

R'' 500

R 500

D of of 352 with R'' + R

S 120

339 Def

77 ohm place down

September 1 1880

Cable 3 layers Jan ~~Rubber Cloth~~

Aug 31 1880 51000

Sept 1 " 4850

Sept 2 3200

~~Sept 2 1880~~

~~Under a~~

~~Got a Pair Pure of Tank~~

~~Rubber Cloth and a Rod pin~~

~~The center, a~~

2-8.2

-.50

September 2 1880

Made an apparatus as follows, to see if any thermo current

exist up.

Put a similar solution [illegible] and a strip of Zinc [illegible] and a strong [illegible] 40, and then gradually fell —

[illegible] concentrated light upon the small piece with [illegible]

no difference, the [illegible] of light went gradually down [illegible] before, [illegible] —

[illegible] with two Daniell cells [illegible] a deg of about 45°

September 2 1880

Cable No 4 3 thick [illegible] Each [illegible] with [illegible] core [illegible]. Res 120 ohms, 2 m.m. 20 laps

78

Sept 2 1882

Some of Phillips

collow Insulite & paraffin wire. Insulation Resistance 36000 ohms.

69 | 52.70 / 3668.0 / 6 / 47 / 5 / 550 / 855 / 2705

3810 / 34.5 / 3844.5 / 394 / 345 / 495 / 34.5 / 1500

111.4 × 34.5 / 5570 / 4456 / 3342 / 3845.30

69 of 1071.4 / 690 / 3810 / 40

111.4 / 35.2 / 222.8 / 5570 / 3342 / 39212.8

528 | 39212.8 / 3696 / 2252 / 2112 / 1408

352 × 1.5 / 1760 / 352 / 528.0 / 74.2 times

352 × 34.5 / 3810 + 34.5 / 31615

3810 / 6900 / 10710 / 6900 / 3810 + 6900 / 6900

3810 / 40 / 352 / 74 / 1760 / 352 / 3884 + 74

74 | 3884 (52.4 / 370 / 184 / 148 / 360 / 296 / 64

524 / 64 / 2096 / 2144 / 36156

69 / 100

15

526 / 9 / 3366

5

3810 / 44 / 3864

Kent Test | Sept 3 1882 | 31

Res of 1 + R.G. 3840 ohms

Con { Def on 1 cell on Condenser without Shunt 69 – 69

Def on Gal of 1 cell. ~~Res~~ 351 – 355
Res of Shunt 6.900 ohm

Def on 40 cells. 350 – 355
Res on Shunt. 34.5

Def on 40 = 69. ~~=~~ 471
Res of Shunt 74 ohms

1 cell + 100000 ohms. Def 351 – 355
Res of Shunt 427. ohm

~~Kent~~ wire Def with 4 cells
54. 50

Insulation 5532040 0.

No. 2

September 3 1880

3 Layers of Rubber each & 3 Layers of Tape. 3200 ohms.

Sept 4	2630 ohms
6	1500
8	2400

Cable No 5 September 3rd

2 thick muslin each served with hot linseed oil.

Sept 3	470 ohms.
Sept 4	140 ohms
Sept 6	110 ohms

Cable No 6 Sept 3

" muslin wound on cable, then served with paraffin, then rubber cloth, then cloth again with paraffin "

Sept 3	1200 ohms
Sept 4	171 ohms
Sep 6	120 ohms.

Cable No 7

" 3 thick muslin each served with coal tar treated with asphalt "

Sept 4	120 ohms.

Cable no 8 Sept 4

Three thickness rubber cloth with rubber cement between 1st and 2d + 2d + 3d layers.

1st 470 / 470

Sept 4 Rs when first put in 12500 In about a half an hour afterwards it went down to 7000. (The water having soaked in of the three layers)

Sep 6 130 ~~180~~ ohms

Cable no 9 Sept 4

3 thick rubber cloth, with paraffine between 1st + 2d and between 2d + 3d layers.

Sept 4 9000 when first put in the water; about a hour afterwards it was reduced to 8500

Sept 6 120 ohms

Sept. 4

Rec of one (Lot) Fallen cells
2 iz others

~~Phillipps~~

Phillips went down from 36000 on Sept 2 to about 250 on Sept 4 1880.

Sept 6 1880

Carbons for Rowland

No 1 Paper with 2 coats. on for 10 minutes in a dilute solution of C.P. Qu SO4

Sept 7 1880

Galvanometer wire 15.5 ohms

Long Carbon 9.40 on 8.0
took it out at 10. was plated
all over.

No 19 Sept 7

Sept 7	79.000 ohms.

No 10 Sept 7 (~~66~~)

Sept 7 2990-00 ohms

Sept 8 1400 ohms

Cable No 12

Sept 7 26000.

Sept 8 1000 ohms

one length of 100 ft of Bare wire submerged in water.

Time	Date	Res	Date							
		127.								

Cable No 1

One Thickness Rubber Cloth (white) opposes overlapping about ½ and varnished with stiff coal tar,

Res. 54 ohms. plates lower down in the water

Cable No 2.
3 layers of Rubber cloth and 3 layers of tar.

Sept	Res	Sept	
Aug		11	2480
31	5700	Sept 13	1910
Sept		14	2100
1	4650	15	2000
2	3200	16	1800
4	2580		
6	1500		
8	2400		
9	2400		

No 3) Two thickness of white Rubber cloth wound in opposite directions

Res 77 ohms.

No 4

3 thickness of cloth.
Faced with boiled coal tar.
Res 120 ohms
Sept 200 Sept 10 200 ohms taken out

No 5 Two thickness cloth each served with hot linseed oil.

Sept	Res	Res Taken out
3	470	
4	140	
6	110	
9	170	
10	170	

No 6 Cloth wound on cable served with paraffin, then Rubber cloth (Black) Cloth again with paraffin

Sept	ohms	
3	1200	taken out
4	171	
6	120	
9	140	
10	130	

7

3 Thickness cloth, served with coal tar, treated with gasoline

Sept 4 12000 ohms taken out

8. Bare wire rubbed with dry hard paraffin

Then Rubber cloth 10% covered with 1st black rubber cement

Then rubber cloth, then cement

Then nipon cloth, swabbed down with hard paper.

4 Sept	12000	Then went down to	
	7000	Sept 10	209
		Sept 17	210
Sept 6	130		
" 9	210		

9 Bare wire rubbed with paraffin,
Rubber cloth
Then cold & hot paraffin
Then rubber cloth and paraffin
and rubber cloth with more
paraffin (cold)

Sept 4 9000 ~~ohms~~ went down ~~to~~ ~~the~~ after being in the water for an hour 2000

" 6 120 ohms.

" 9 120 ohms.

10 120 ohms

Took the cable into and had the ~~the~~ ends lifted up and measured it endwise.

Cable. Sept 11.

0	320 ohms
1	324 "
2	390 " "
3	500 " "
4	550 " "
5	555 " "
6	580 " "
7	580 " "
8	540 " "
9	544 " "
10	544 " "
11	570 " "
12	570 " "
	630 " "
	750 " "
	970 " "
	" " " "
	1000 " "
	1200 " "
	1400
	1500

10 Rubber cement on bare wire then Rubber cloth, muslin, Compound #7, rubber cloth, rubber cement, rubber cloth, Rubber cement, ~~rubber cloth~~ ~~Rubber cement~~ dusted with chalk.

Sept 7 299000
" 8 . 14000
" 9 . 500
10 . 450

Troll Rubber cement on bare wire Chalk
Rubber cloth
muslin
compound #7
Rubber cloth
" cement
cloth
cement
Dusted with chalk

Sept 7 79000
" 9 240 ohms
10 215 ohms

$$cX + cr + cy = c_1 P + c_1 x + c_1 y$$

$$cX = -cr + c_1 y + c_1 P + c_1 x + c_1 y$$

$$c(R + r + y) = c_1(P + x + y)$$

$$y = \frac{c_1}{c}$$

$$R = \frac{a_1^0}{a^0}(P + y) - y$$

$$R = \frac{a_1^0 a_1^0 P - a_1^0 y}{a^0} - y$$

$$a^0 R = a_1^0 P + a_1^0 y - a^0 y$$

$$a_1^0 y + a_1^0 y = \frac{-a^0 R + a_1^0 P}{a_1^0 + a^0} = a$$

10000 (10000)

12 Muslin on bare wire
Compound #2
Muslin soaked in linseed
Compound 2 #2 thinned with Cotton
seed oil Muslin
Rubber cloth
" " cement
Rubber cloth "

Sep 7, 26000
" 8, 10000 ohm
" 9, 740 ohms
" 10 540 "
" 13 300

No 13. 5-6

20 wire covered with Marlin
then boiled in compound
#3 then Rubber Cloth

14 7. strands wound with
marlin.

15 Muslin
Refuse Compound
Muslin
Refuse Compound
Sept 13 Re 140 ohms

16 White rubber cloth layers
Boiled pine tar 2 servings
Made to compare with #2

Sep 13
176000 ohms
~~55000~~
Sept 14 ~~65 000~~ ohms
" 15 200000 ohms
" 16 12500 ohms

17

18

19

Rubber cloth
Compound #7
Rubber cloth
Compound 7
Rubber cloth.

Compound 7
Oxezad. Linseed
oil Rind tar
+ vaseline.
+ paraffine

Sept 10 1880

8 32 - 22 55 Machine 182 = 7/183
60
20

Machine 11

8 - 22 - 31.5 × 89.0 = 59.

R = 64 63.5 = 179 # 179.

Machine 10

8 44 = 62.5 176 ÷ 177 59

Machine 4

8 64 - 44 163 - 160 -4

55 120 5.
4
10
11

87/182 (5.6 216 3
56
1296
1080
1296 120.96 216
28
1728
216
3888

64)179 (2.8
128
510

$\frac{v^2}{R} = 4.43$

Machine No. 4 Knitted
more than [illegible]
Marked thus
6¼ X 9
The resistance of armature .14
Magnet 1.7 Ohms
Line all right
[illegible]
[illegible] magnet

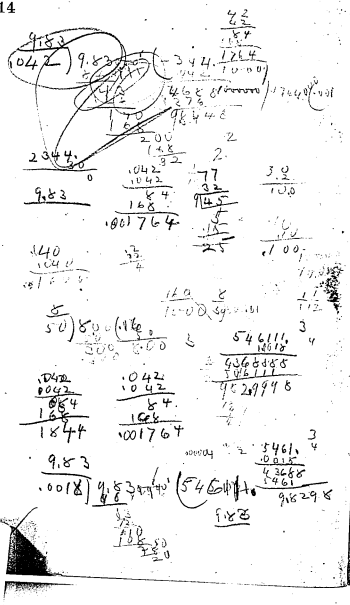
Magnets

.55 [illegible]

[illegible]

Leading wire .06

1	.14	19	14
2	.15	20	14
3	.14	21	14
4	14	22	14
5	14	23	14
6	14	24	14
7	14	25	14
8	.19	26	17
9	14	27	19
10	14	28	30
11	14	29	14
12	14	30	14
13	14	31	14
14	14	32	14
15	14	33	[illegible]
16	14	34	[illegible]
17	14	35	14
18	14	36	14
		37	14
		38	14



Sept 16 1880

testing The per cent of cu in The wire. for The arm ature.

Length 30 ft Temp. 77° Fn

Diameter .0424

.0415
.041
.0415
.041
.042
.0415
.0415
.042

Res. .185 ohms.

Length 30 ft Temp 77° Fn

Weight in grams 108.6 grams for 30 ft

108.60
108.60 in 30 ft

4/9.83
2.4

12
42
84
165

1764 | 9.8300 (.005
1 01200
1 8820

1764 20 | 1764 8 20 2 3

1764 8 | 1584 2 3

1764 | 1520 2 3 | 9.7020

1764 | 1520 2 3 | 9.7020

.005
.30
.01650 5 4
1.09
14.850
165
.017850

.017850 ÷ .185 = .100

.18 | .0

.20835 4 4
.104
1.8765
2.0835

2367 | 2.20835 (.9
21303
1.42.35
142.02

9.830 2
294900
1.09
2.65410

1764 | 2.331410 (.18
1764
1.6710
1.4112

1764 3 | 4112 65 4

185 | 18.02 (.97 (parcelly 1 1.7250 | 1.8500 | 1.8500 | 1.8500

Lesson No 19 Cable

Def on one cell 300 R 305 Res of S 1260

300 / 305 / 2605 / 302

302

302 / 4.09

2718

1208

12551.8

3900 / 1260 / 5168 (4.09

1200 / 1.24

3900 / 44.4

3944.4

444 / 3996

3

44.4) 3944.4 (88.

352

3924

88 / 2416 / 2416 / 26576

15518) 265768 (17.

510

15517

110490

102662

18640

15518 / 9662

2

111

15518 / 15518 / 1241444

15518 / 108626

15518

108626

269806

302 / 27 / 2114 / 604 / 8154

12350) 365674 (21.155)

1867

1235

2320

148 / 3635

3900 / 148

4048 (27.

148

4048 / 148

60

2

26567 (17.

155

1085

1085

217

148) 4048 (27.

1085

1085

1

3.810 ohms

Def one cell L300 R305 Res of S 1260 ohms

" 20 " L300 R305 Res of S 4414 ohms

(Def of one cell through 10000 ohms L300 R.305

Resng S 148 ohms.

Def on cable 300 . 307 Def

Res shunt 1070

S 974 300 : 307

S – 940 Gal R 3900

1235.18

~~15518~~ Def of one cell without S

26567.

21.1 hms

8154

21.1

8154

8154

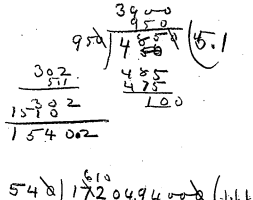
16308

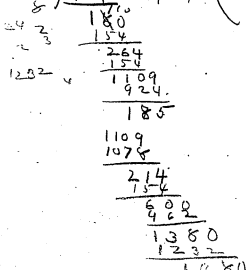
172049.40

10000

172044000

Res 1117.138. ohms





202.5
203
~~4055~~
135

251.50
40
2915
157 160

2.1303
2.1303
1.6060
7.8356
3.7426 5536

Res	~~31400 +~~ NO 91
EMT	202.5 – 203
Res	25150 + 4000 / 200
C	48
But	32–32
EMT	168 –
Res	25150 + 5900 / 200
C	16

237
236
~~478~~
158

376.5
5
1381
190

2.1987
2.1987
1.6969
3.7212
3.7650

5820

237
236
~~1433~~
~~1474~~

37650
500

20)3815 (190 lbs
180
180

E.M.7 237 — 236 no98
C 48
Res 37650 + 500
200
Blue at one of the clamp

E.M.7 217 — 216
Res 37650 + 2400
200
C 16

37650
500
20)4815 (L9
40
180

215
3 | 430
143

Emt 215 − 215 No 36

Rs 314000 + 5000
200

C 4 +

Emt 180 − 182

Rs 314000 + 7000
2000

Rs 16

314000 143 √
5000
204 | 2540 0 | 182 R
204
186
8

E M7 244 - 244 No 17

Res $\frac{37650 + 2800}{200}$

C 48 Blue at the Ch...

E. M7 209 - 209

Res $\frac{37650 + 5600}{200}$

C 16

37650
2800
162 0
20/49450 (202 R

244
3(488
162

Emt 225 − 220 no 43

Res $\frac{31400 + 4300}{200}$

C 48 Blue at Dawn + [illegible]

E.Mt 195 + 197

Res $\frac{31400 + 6400}{20}$

C

31400 1505
4300
20) 35700 (178 R
20
157
140
170 225
3) 450
150

E.M.H 204 − 203 ho47

Pbs 31400 + 1500

2000

C. 4%

E.M.H 173 − 172

Pbs 31400 + 3500

2000

C 16

204
203
407
133

31400
1500
1355

20)33200 (1660 R
20
133
120
128
120
8

Emt 194 − 194 → 40

Res 25150 + 6100

200

R 45

Emt 164 − 163

Res 25150 + 7800

200

R 16

25150
6100
31250

20)31250 (1295
20
113
100
125

194
3)388
129

240 212

1100 675

E.No. 240 - 241 No 45

Rs 37650 + 5300

200

C 41

E.No. 212 - 212

Rs 37650 + 7900

200

C 16

37650
5800
43450

2043450 (1605
29 214 R
29
95

341
340
1481
16

EMT 211 - 211 no|

Rs 31400 + 400 / 200

C 48

EMT [illegible]

Rs 31400 + 5600 / 200

P 16

31400 / 400 1400

20) 31800 (159 R.

115

100

1800 / 1800 1422 / 140

Ent 214 – 214 no 75

Rs $\frac{31400 + 1400}{200}$

C 48

Blue in stamp.

E. M 190 – 190

Rs $\frac{3100 + 31400}{200}$

C 16

31400
1400
20) 32800 (1425
20
128
128
80

81428
142

E.Mt 206 – 208 Ans

Rs $\frac{31400 + 1800}{200}$

e 48

E.Mt 175 – 177

Rs $\frac{31400 + 3700}{200}$

e 16

31400
1800
33200 (1385
2) 33200 (166 R
132
120
120 206
208
2(414
138

173
164
212
176
177
8 177 00
7 86
930
1392
1116
125.5.5.6

225
209
2 00
2 11
2 11
222
8 177 23
2 15
6 5

E.M7 229 – 230 2092

Res 37650 + 1600
200

e 48 Blue air Champ

Em7 196 – 198

Res 37650 + 4200
200

e 1.6

37650
1600
39250 1530
20) 39250 (196 Rs
20xx
192
180
125

229
236
3459
153

12 25 20

$20y = 25y$

6

$\frac{x-20}{12} = \frac{x}{6} - 20$

20

$x - 20 = 2x - 40$

$x - 2x \quad +20$

$-x = -20$

20

20 25

x

$\frac{x-20}{12} = \frac{x}{6} - 20$

$x - 20 = 2x - 40$

20

$x - x = 20$

$\frac{x-20}{12} =$

$\frac{x-15}{12} =$

$\frac{x-20}{12}$

$x \quad \frac{x}{12} =$

1

$\frac{x-20}{12} =$

$\frac{x-15}{12} = \frac{x}{6} - 15$

$x - 15 = 2x - 180$

$-x$

$\frac{x-15}{12} = \frac{x}{6}$

$\frac{x-15}{12} = \frac{x}{6} - 15$

$x - 15 = 2x - 180$

$-x$

15
12
30
15
180

165

$$\frac{x-15}{12} = \frac{x}{6} - 15$$

$$\frac{x-20}{12} = \cancel{x}$$

$$\frac{x-20}{12} = \frac{x}{6} - 20 - 5$$

$$x - 20 = 2x - 240 - 60$$

$$\begin{array}{r} 60 \\ -300 \\ 20 \\ \hline 12\overline{)240} \end{array}$$

$$\frac{x-20}{12} = \frac{x}{6} - 25$$

$$\begin{array}{r} 25 \\ 12 \\ \hline 50 \\ 25 \\ \hline 300 \end{array}$$

$$\cancel{2x}$$

$$x - 20 = -2x$$

$$\frac{x-20}{12} = \frac{x}{6}$$

$$\frac{x-20}{12} = \frac{x}{6} - 215$$

$$\begin{array}{r} 12 \\ 15 \\ \hline 60 \\ 120 \\ \hline 180 \end{array}$$

$$x - 20 = 2x - 180$$

$$\begin{array}{r} 175 \\ 276 \\ \hline 90 \\ 90 \end{array}$$

$$\begin{array}{r} 12\overline{)180}\ (15 \\ 60 \\ \hline 60 \\ 60 \\ \hline 180 \\ 180 \end{array}$$

$$x$$

$$-x$$

$$\begin{array}{r} 15 \\ 30 \\ \hline 180 \end{array}$$

$$\begin{array}{r} 5 \\ 12\overline{)180} \end{array}$$

$$180$$

$$x - 20 = 2x - 10 - 180$$

$$\begin{array}{r} 20 \\ 170 \end{array}$$

$$x =$$

$$x \quad x$$

$$12 + 60 = x$$

5 10

$\frac{1}{5}$

2.

E Wt 212 – 212 ho 90

Res 31400 + 1400 / 2000

e 48

Blue at the Clamp

E Wt 185 – 185

Res 31400 + 33000 / 3000

e 16

31400
1400
1415

20) 33800 (1690
20
138
130
80
80
424
141

Emt 232 − 235 1089

Res $\frac{37650 + 4100}{200}$

C 48

Blue at the Camp

Emt 215 − 215

Res $\frac{37650 + 5700}{200}$

C 16

37650
4100
41750 (208 R 1555
200)
175

233 $\frac{233}{235}$
$\frac{467}{1555}$

E.M7 242 – 242 No 93

Res 37650 + 5600
200

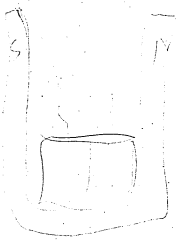
C 48
Blue on the clamps

E.M7 215 – 218 No 93

Res 37650 + 7600
200

C

37650
5600 161
20)43350 (216 R
22
125 242
5)48 X
161



E.M7 229-229 no 88

Rs 31400 + 5200
200

C 48

Blue at the clamps

E.M7 203-203

Rs 7500 + 31400
200

C 16

31400
5200
36700 1525
20) 36700 (183 R
20
167
160
70
229
3) 458
152

E.M.T. 225 − 223 No 87

Res $\frac{3000 + 31400}{200}$

C .48

Bleed the clamp

E.M.T. 195 − 197

Res $\frac{4900 + 31400}{200}$

C 16

314000
3000 1490
20)34480 172 R
34
140
40

225
223
2)448
149

Em 7 232 - 235 2086

Res 31400 + 6000

200

C 48

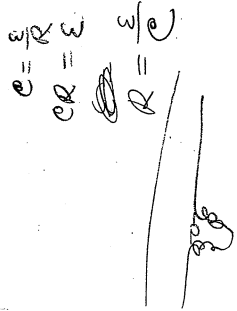
Blue on the clamp

Em 7 205 - 205

Res 31400 + 8500

C 16 200

31400
6000
20 | 37400 (187 R
20
174
0 00
1 40
1 40
232
205
= 467
105



Oct 9 1880

Test of some samples of german Silver wire for the results coils down the factory

at meters
9.6.25 of no .022 = 3 ohms
13 ft 1 meter of no .072 = 1 ohm.

no .015. 7 ft 4 in = 5 ohms

Oct 14 1888

1250

Oct 18 188

Plate 11 marked

$\frac{11}{2}$ = 1250 ohms

$\frac{11}{2}$ = 1480 " "

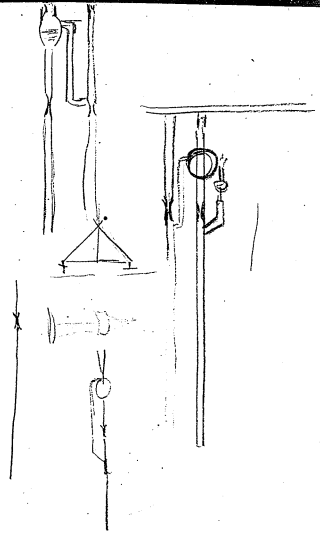
$\frac{1}{2}$ = 1250 = ohms

111 = 1250 "

11 = 1240 "

1 = 1350 " "

a = 3000 "



Oct 19 1880

Tried the experiment of working out the dyed-carbon ~~[illegible]~~ First one I took and tried, was to bring the carbon up bright when I had the vapor of Chloroform I got a thick deposit of Carbon.

~~second~~. final

Was a carbon tried in the vapor of Bisulphide. This carbon was burning for about ten minutes in the vapor and then I took it out. Carbon seemed to be good.

Second Def. 215

This carbon was
on the cathode for
[illegible] minutes and
gave a good light.
and carbon when
castor oil was used

Third. 210

This carbon was burning on the anode for
[illegible] minutes and
20 minutes [illegible]
a good bright light.
I follow Tick I cut

Oct 20 1880

[illegible]

[illegible] some [illegible]

[illegible] a [illegible]

[illegible] a [illegible]

Some [illegible]

formed in the [illegible]

[illegible]

which [illegible]

[illegible]

Oct 21 1880

Oct 2, 1880

Made an experiment by generating gas from (gasoline) in a flask and then passing it in a matrass in which there were some carbons. When finished, we found that they were covered (with

took a carbon bases and pass gasoline gas through it would when it was a charged, when taken out they did not seemed to be coated. Then took some dis= coal and put them in when taken out a very fine film was found on them.

C.

Oct 23 1880

tried some Carbons with gasoline. got it up to a very high heat. the deposit on it was a kind of woody substance.

Also tried some with the oil of tar in it and got it up to a very high heat

~~Had some~~

Had some carbons also with paraffin in. got this one up to a very high heat.

Oct 26 1890

tried some nitrithalin by boiling some of it in a flask fitted for an air bath in the manner in which I [illegible] the gas, ~~was it~~ I put it on the bottom of the [illegible] two pieces of card board and then placed two carbons on top of them and then covered the carbon pieces [illegible] and heated it to a pretty good heat, nearly

white! when taken out of the [illegible] a very appearance the carbon had this black [illegible]

Tried it again with nitrithalin, but we need before we could [illegible] good results.

We also tried [illegible] it was to be supp[illegible] [illegible] with [illegible] but [illegible] result,

[illegible]

40

6) 20 → 4 8 5 0
13 3 2 0 7

1.4 5 0 7 4
13 3 2 0 7

43.2
86.4

64) 1 3 3. (2
1 2 8
5

Dec 7/1880

40 = 64 of.

20) 64. (1.6 = one cell
20
20

~~1.0 5 0~~
~~4 0~~
~~4 6.2 0~~

1.0 5 0
4 0
3 4 3.2 0 ✓

64 = 43.2

64) 43.0 (.675 = 1
3 8 4
4 6 0
4 4 8 2

.675) 33.000 (.7
[illegible]
[illegible]
[illegible]
[illegible]

8.3645163
1.8061

43.2) 64.0 (1.48
43.2
20.8 0
17.2 8
3.5 2 0

1.7069 63
148

heating wire = 21 ohms

Def from machine without

multiplets 16.5 × .675 = V

.675
825
1155
990
11.1375 Volts

$\frac{\pi^2}{.28} \times 44.3$

1L

.1702617
.9294189
2.0996806

125.8

Dec

537.6 –

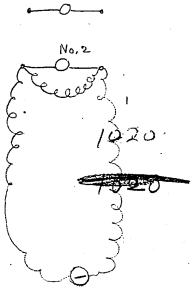
108
20
2160 volts

105
40
4320

4320 volts

64) 200 (3.1
192
80

4.3.



Dec 11 1880.

* 76 − 76 45° | 16

6279 Face 22

360

200) 6644 (33.90 ~~04~~ 1/3.

600

640

600

40

33 ohms

~~1.0000136~~

~~3.7616272~~

~~3.7616272~~

~~8.4814861~~

~~1.6464037~~

~~3.8895170~~

~~7753.~~

~~77~~

76

76

7729) 33 0 0 0 (4.1 H.P.

~~39~~ 9 1 6

10840

33) 2 8 6 0 (7729.

2 3 1

240

231

09

320

297

2

7

1.7101174
3
3.4202348
1.6464037
5.4481861
3.5481246

3532.

3532.)

5480

4.5185139
3.5481246
1.0303893

1.0540
4.3020
43.25

43.2 : x :: 64 : 76
76
2592
3024
64) 32832 (51.35
32064
768
384
384
192

355
3532) 3178 (9.8
124.20
1121.28

2

48 e

Def 91 –

6279
230
200)6509 (32.5
600
509
400

5142.

330

43.2 : 4 : 64.91

1.6354837
1.9590414
8.0193819 0
1.7883441
2

3.5766882
1.6464037
8.4881166
3.7112085
5

6.2887915
4.5185139
1.8073054

6.4 HP.

Second Trial

Day or Lump. 72 − 72

Bait 63.64

6279
870

64
2127
63.5

20)6649 (33.

649 43.2 : 63.5 72

1.63548837
1.85733325
8.19722263

1.69104262

3.3820852
1.6464037
8.4814861

3.50997500 ft lbs
6.49002500 3235.
4.51857139
0.04853.89 H.P.

43.2
72

864
3028
2

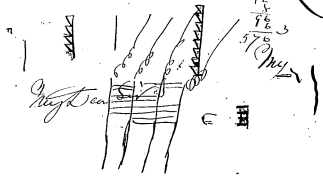
63.5) 3108.4 (5
3175

64) 31104 (48
256
550
512
38

33) 10636.0 (3221.
99
73
66
70
66
40

3221) 32000 (4
25884
40110

Par P Para Parallel Lost



Small coils

~~3 ohms 0.25~~

$3\frac{25}{100}$ ohms

$3\frac{27}{100}$ ohms

130

large coil

32.50 ohms (X)

33.50 ohms

378

51

33) 115220 (3491.
99
162
132
302
297
50

3491) 320000 (91.4
31419
15810
13964
1846

Res of a Battery

$\frac{s}{s}\ \frac{1}{s}\ \frac{20}{15}\ \frac{2}{s}$

$$C = \frac{\mathcal{E}}{r + \dfrac{S(R+G)}{S+(R+G)}}$$

current through the gal =

$$\frac{\mathcal{E}}{r + \dfrac{S(R+G)}{S+(R+G)}} \times \frac{S}{(R+G)+S} =$$

$$\frac{\mathcal{E}\cancel{(S+(R+G))}}{r(S+(R+G)) + S(R+G)} \times \frac{S}{\cancel{S+(R+G)}} =$$

$$\frac{\mathcal{E}S}{r(S+(R+G)) + S(R+G)}$$

$$C = \frac{\mathcal{E}}{R+G+r}$$

$$\frac{\mathcal{E}S}{r(S+(R+G)) + S(R+G)} = \frac{\mathcal{E}}{R+G+r}$$

$$\mathcal{E}S(R+G+r) = \cancel{\mathcal{E}(rS+rR+rG)}$$

$$\mathcal{E}(rS+rR+rG+SR+SG) =$$

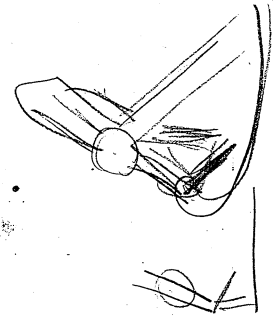
$$\cancel{\mathcal{E}rS + \mathcal{E}SG + \mathcal{E}SR}$$

$$\cancel{CrS + CrR + CrG + CSR + CSG}$$

$$\cancel{\mathcal{E}Sr \quad CrS \quad CrR \quad CrG} =$$

$$\cancel{\mathcal{E}SR} + \cancel{\mathcal{E}SG} + \cancel{\mathcal{E}Sr}$$

$$\cancel{\mathcal{E}rS} + \mathcal{E}rG + \mathcal{E}rR + \cancel{\mathcal{E}SR} + \cancel{\mathcal{E}SG}$$



$$\frac{\varepsilon s}{r(s+R+y)+s(R+y)} = \frac{\varepsilon}{R_1+y+r}$$

$$\cancel{\varepsilon s R} + \cancel{\varepsilon s y} + \cancel{\varepsilon s r} =$$

$$\varepsilon r s + \varepsilon r R + \varepsilon r y + \cancel{\varepsilon s R} + \cancel{\varepsilon s y}$$

$$\varepsilon s R_1 + \cancel{\varepsilon s y} + \cancel{\varepsilon s r} =$$

$$\cancel{\varepsilon r s} + \varepsilon r R + \varepsilon r y + \varepsilon s R + \cancel{\varepsilon s y}$$

$$\varepsilon s R_1 = \varepsilon r R + \varepsilon r y + \varepsilon s R =$$

$$r = \frac{\varepsilon s R_1 - \varepsilon s R}{\varepsilon R + \varepsilon y} =$$

$$r = \frac{s(R_1 - R)}{R + y}$$

$$r = \frac{s(R_1 - R)}{R + y}$$

Def	V	Def	U	Def	V
	20 cell =		32 cell		1 cell = 1.6214
1	.675	21	14.17	41	27.67
2	1.35	22	14.85	42	28.35
3	2.02	23	15.53	43	29.02
4	2.70	24	16.20	[illegible]	29.70
5	3.38	25	16.87	[illegible]	30.37
6	4.05	26	17.47	[illegible]	31.05
7	4.73	27	18.22	47	31.72
8	5.40	28	18.90	[illegible]	32.40
9	6.08	29	19.57	[illegible]	33.07
10	6.75	30	20.25	[illegible]	33.75
11	7.43	31	20.92	51	34.42
12	8.10	32	21.60	52	35.10
13	8.78	33	22.28	53	35.77
14	9.45	34	22.95	54	36.45
15	10.10	35	23.62	55	37.12
[illegible]	10.80	36	24.30	56	37.80
[illegible]	11.47	37	24.97	57	38.38
[illegible]	12.15	38	25.65	58	39.15
19	12.83	39	26.32	59	39.82
20	13.50	40	27.00	60	40.50

log 1.4144 = 10.1506952 142

61	41.17	80	54.00	98	66.15
62	41.85	81	54.67		
63	42.52	82	55.35	99	66.82
64	43.20				
65	43.87	83	56.02	100	67.50
66	44.55	84	56.70	101	68.17
67	45.22	85	57.33		
68	45.90	86	58.05	102	68.85
69	46.57	87	58.72	103	69.36
70	47.25	88	59.40	104	70.036
71	47.93	89	60.07	105	70.47
72	48.60	90	60.75	106	71.55
		91	61.42		
73	49.27	92	62.10		
74	49.95	93	62.77		
75	50.62	94	63.45		
76	51.30	95	64.13		
77	51.97	96	64.80		
78	52.65				
79	53.32	97	65.47		

107	72.23	121	81.67	135	91.12
108	72.90	122	82.35	136	91.80
109	73.58	123	83.03	137	92.47
110	74.25	124	83.70	138	93.15
111	74.93	125	84.37	139	93.82
112	75.60	126	84.97	140	94.50
113	76.28	127	85.72	141	95.17
114	76.95	128	86.40	142	95.85
115	77.60	129	87.07	143	96.52
116	78.30	130	87.75	144	97.20
117	78.97	131	88.42	145	97.87
118	79.65	132	89.10	146	98.55
119	80.33	133	89.78	147	99.22
120	81.00	134	89.45	148	[illegible]
				149	100.57

150	101.25	166	112.05	181	122.17
151	101.92	167	112.72	182	122.85
152	102.60	168	113.40	183	123.52
153	103.27	169	114.07	184	124.20
154	103.95	170	114.75	185	124.83
155	104.62			186	125.55
156	105.30	171	115.43	187	126.22
157	105.88	172	116.10	188	126.90
158	106.65	173	116.77	189	127.57
159	107.32	174	117.45	190	128.25
160	108.00	175	118.12	191	128.92
161	[illegible]	176	118.80	192	129.60
162	109.35	177	119.47	193	130.27
163	110.02	178	120.15	194	130.95
164	110.70	179	120.82	195	131.63
165	111.34	180	121.50	196	132.30
				197	132.97

198	133.65	216	145.80	235	158.62
199	134.32	217	146.47	236	159.30
		218	147.15	237	159.97
200	135.00	219	147.82	238	160.65
201	135.67	220	148.50	239	161.32
202	136.35	221	149.17	240	162.00
203	137.02	222	149.85	241	162.67
204	137.70	223	150.53	242	163.35
205	138.38	224	151.20	243	164.02
206	139.05	225	151.87	244	164.70
207	139.73	226	152.47	245	165.37
208	140.40	227	153.22	246	166.05
209	141.08	228	153.90	247	166.72
210	141.75	229	154.57	248	167.40
211	142.43	230	155.25	249	168.07
212	143.10	231	155.92	250	168.75
213	143.78	232	156.60	251	169.42
214	144.45	233	157.28	252	170.10
215	145.10	234	157.95	253	170.77

254	171.45	275	185.62
255	172.12	276	186.30
256	172.80	277	186.97
257	173.38	278	187.65
258	174.15	279	188.32
259	174.82	280	189.
260	175.50	281	189.67
261	176.17	282	190.39
262	176.85	283	191.02
263	177.52	284	191.70
264	178.20	285	192.33
265	178.84	286	193.05
266	179.55	287	193.72
267	180.22	288	194.40
268	180.90	289	195.07
269	181.57	290	195.75
270	182.25	291	196.42
271	182.92	292	197.10
272	183.60	293	197.77
273	184.27	294	198.45
274	184.95	295	199.13

296	199.80
297	200.47
298	201.15
299	201.82
300	202.500

951)4900(.05
1,55

921.7900 (.0 ×5
1368
53.20

2

1.6879746
2.9782947
2.7096799

1.497 62 71
2.964 25 96
2.93333675 .0512 .0857
.0512
.0345

1000 − 48.75

48.75 mm leading wires

79 leading wire + machine

1000.00
48.75
951.25

48.75 : 951.25 :: 1 : X

2.9782947
1.6879746
0.2903201

1000
79
921

1.95

951.25 : 48.75 : 1 X
921 : 79 : 1 X

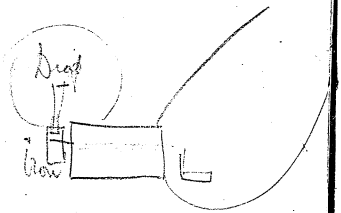
115 Chrny 10000

33% 10000

52

52) 6 5 0 0 0 0 (65000
3 1 2 +
260
260

2 | 2



Feb 6

Melin Lagrange

68.D = 300

1.05
3
6.48

6.48) 300.00 (46.2
2592
4080
3888
1920
44

46.3
2778

46.3
3
27.5.8

46.3
648
3704
1852
2778
29024

46.2 Def = 10

Rec of Mo. 6

10

20
20
400
4.4
1600
1600
17.600
70,400
10.
281,600

2

40
40

134
134
536
402
134
.17956
7854

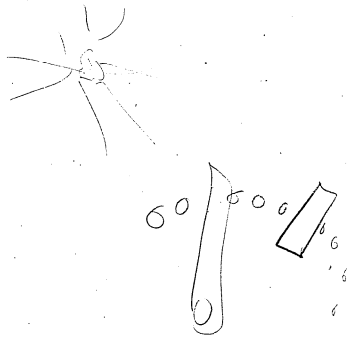
.07854
.7854
31416
7854
.0785.40
40
4398240

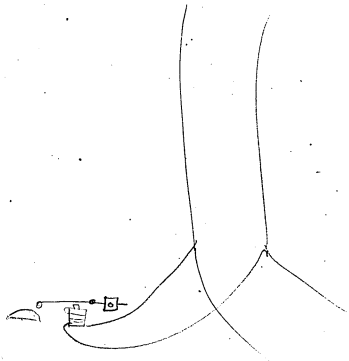
1

.47956
40
7.18240

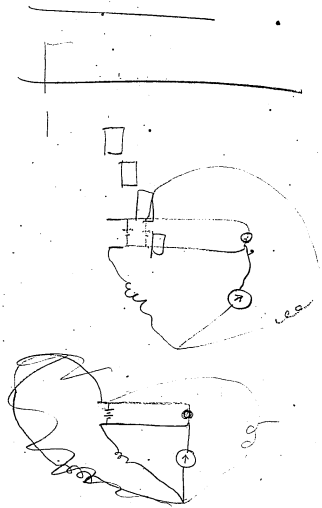
1.357

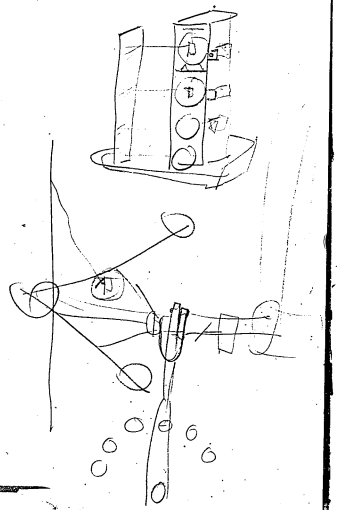
.4398





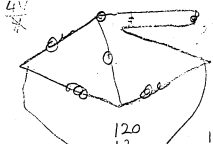
110





$\frac{x}{10} + 10 = \frac{x}{4}$

$2x + 200 = 5x$

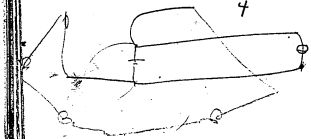


$\frac{x}{10} + 10$

$\frac{x}{x} + 10 = \frac{x}{x}$

$\frac{x}{4}$

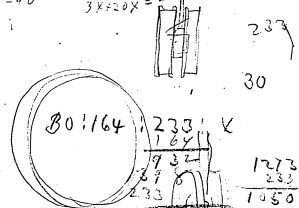
$x + 100 = x$



$\frac{x}{10} + 10 = 4$

$\frac{x}{4} - x = 10 + \frac{1}{20}$

$x + 100 = 40$



$\frac{C}{E}$

$\frac{E}{C}$

$r = \frac{E}{C}$

Dy on magnet Dof

31

112 4.0984360
141 1.6464037
     7.8507809

3.5956206 H Co.

6.0404370 4
4.5185139

0.9228583

8.4 H.P.

20

119
157

40

4.1510949
1.6464037
7.8041003

3.5015980 H Co

6.3984010
4.5185139

0.9769149

~~8.7~~ H.P. 8.2 H.P.

Dec 14th 1800

#10 Magnet	machine		#5 magnet	machine	
0	18	18	0	12	12
0	28	28	1	20	20
1	40	40	2	32	31
2	51	52	3	40	40
3	63	63	2	50	50
3.5	74	74	4	59	59
5	89	89	5	70	70
8	107	107	5.5	85	85
10	119	119	7	105	105
11	130	130	11	122	122
16	140	140	14	131	131
22	145	145	11	138	138
32	155	155	19	142	142
68	170	170	30-31	150	150
			65	165	168

Dec 14

1 W. = 124

2

170
3340
113

Lamp 184

185
370
123

166 ohms

15) 64 (421.
60
40
30
10

4.1798102
1.6464027
7.7798919 2

3.6061058

6.3938942
6.3185139

3.9124083

8.2 H.P.

1/4 lamp

16

111.0
138 R

4.0906460
1.6464037
7.8601209

3.5971706

6.4028204
6.3185139

3.9210065

8.3 H.P.

1.4844
56
5926
74070

123

15

Lang 19

105.

136 R

4.04237786
1.6464037
7.8664011

3.5555434

6.44475566
6.5785129

0.9632105

9.2 H R

4.04237786
1.6464037
7.9786107

3.6675930

6.3324060
4.5786139

0.9539199

8.9 H.R.

105. ~~E~~ v $R = R_1$

$$e = \frac{\mathcal{E}+\mathcal{E}_1}{R} = eR = \mathcal{E}+\mathcal{E}_1^x$$

$$e_1 = \frac{\mathcal{E}-\mathcal{E}_1}{R} \qquad eR = \mathcal{E}-\mathcal{E}_1^x$$

$$\mathcal{E}_1^x + \mathcal{E} = eR$$

---

to lies Maschinx ~~ey~~

$$\left.\begin{matrix} R \\ R_1 \end{matrix}\right\} \begin{matrix} x \\ y \end{matrix} \Big\} = R+R_1 \Big| \begin{matrix} e \\ e_1 \end{matrix}$$

$$e = \frac{\mathcal{E}+\mathcal{E}_1}{(R+R)R_2} = eR = \mathcal{E}+\mathcal{E}_1$$

$$e_1 = \frac{\mathcal{E}-\mathcal{E}_1}{(R+R_1)R} \qquad eR_2 = \mathcal{E}-\mathcal{E}_1$$

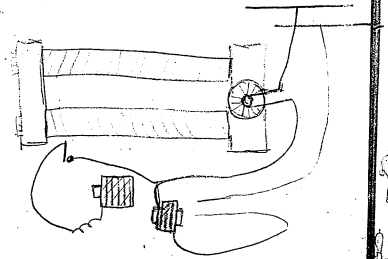
$$R_2 = \frac{\mathcal{E}+\mathcal{E}_1}{}$$

$$R_2 = \frac{\mathcal{E}\,e - \mathcal{E}}{e_1}$$

105-5 from 130-160

4.0423786

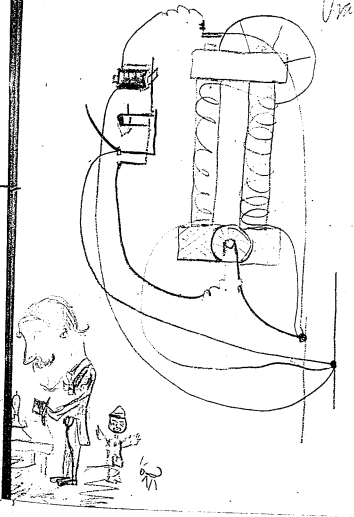
4.0423786

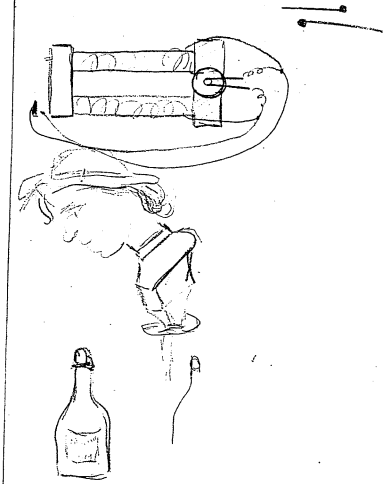


Dec 21 1878

Edison Motor

Frank





18840
4
23360
~~11680~~ ohm

18840
4800
23640
113.2

$$\begin{array}{r} 1000 \\ 90 \\ \hline 910 \end{array}$$

90 : 910 : 10 : x

$$\begin{array}{r} 2.9590414 \\ 7.0000000 \\ \hline 8.0457575 \\ \hline 2.0047989 \end{array}$$

Ramp to get 1's curve

Res	Elev	Cm	R	E	C
Cold					
176	13.50	0	116	99.24	14
129	66.85	1	116	99.97	15
126	75.60	2	115.5	101.25	16
125	79.65	3	115	101.9	17
122	84.37	4	114.5	103.29	18
121	85.72	5	114	104.62	19
120	87.75	6	113.5	105.20	20
119	89.45	7	110	108.	25
115	91.12	8	109	110.70	30
118	93.82	9	107.5	112.72	35
117.5	94.50	10	105	117.45	50
117	95.17	11			
116.5	95.85	12			
116	97.87	13			

31406
3 times

2) 35206

176 ohms

71.14 : 35206

$$\frac{X}{35206} = \frac{71}{14}$$

R	C	V	R	C	V
Coell					
174	0	13,50			
133	1	7087			
125,5	5	8775			
122,2	10	95,85			
120	15	101,25			
118,[illegible]	20	106,65			
116,5	25	109,35			
116,[illegible]	30	112,05			
114,5	35	114,75			
112 –	50	118,80			

31406
3500
2 349 06
174

18840
5600
24440
122,2

25127
1500
2 126627
133

12563

18840
4500
23340
117,5

18840
5600
24440
122,2

18840
5200
24000
120

18840
4300
23640
118,2

18840
4100
22940
114,7

18840
4350
23190
115,95

·01 machine Jan 21 1941

def. Rev 76

76 1030

78 1030

53) 6500000 (122

53

1200

1060

1400

1060

3400

12560

.500

12560

.577

87920

87920

6280.00

1052) 7247.120 (1.3865.

1052

2047

1056

4910

4688

1900

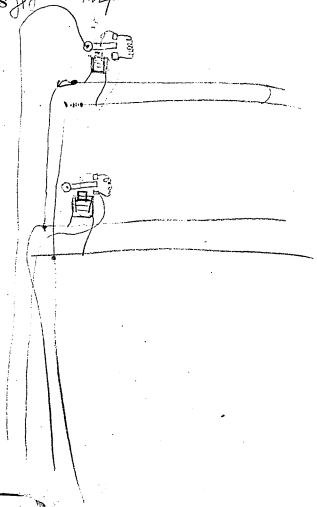
1560

3400

3156

2600

1.124900



C	F	
37	7	139
1	2	147
2	3	155
3	4	167
4	5	183
2		

800 : 200 × .01875
800
14.9600

200) 14.9600 (.6
.01870 0
200) 14.9600 0 (.07

.1700
139
861

861 : 139 : × .0187
861
187
1122
1496

139) 16107 (.11
139
220
139

4536 / 10000 (2.20

4072

4280

4072

2800

1390

22

27780

27780

30580 ft = 1 Cal

4403

2)1 2

1 C = 22 J. W

772
2.2
1544
1544
1698.4 ft lbs. for Cal

1 W = 44.3 ft lbs.

.240 65
84920
91904
67936
889 68
8779960
4086.1960

5
8 3 2

1390 ft lbs

1390 ft

1390 = calories
.2 40
55600
2780

44.3 0
2 4
1 7 7 2 0
1 8 6 3 2 0
1 0 6

772
.02
1544
1544
1698.4 ft lbs

)1698.4

4)150 (25
20

4/10) 40

44.3 ft w.

W = 44.3 ft lbs

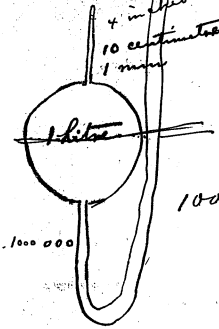
1698.4

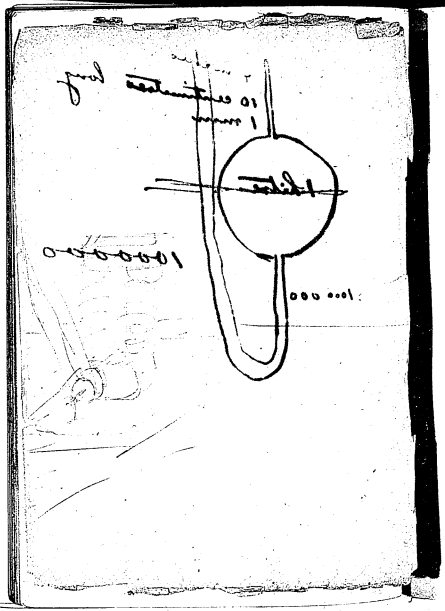
1698.4 ft = 1 C.

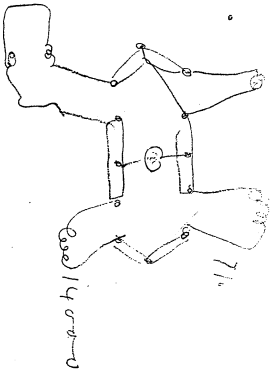
.2 ft)1698.40000 (
169.8

100) 1698.4 (16.98
100
698
600
984
900
84

16.98
.24
6 7 6
3 3 8
4 0 7 2


4 inches
10 centimeters long
1 mm
1 litre
1000000
1000 000





$\frac{5}{9} - 32 = c$ $\quad \frac{5}{9}(7-32) = c$

$c = \left(-\frac{5}{9}7 + 32\right)$

46

$\frac{5}{9}(7-32) = c$ $\quad \frac{5}{9}(7-32) = c$ 70

$\frac{57}{9} - \frac{160}{9} = c$ $\quad \frac{57}{9} - \frac{160}{9} = 70$

$57 - 160 = 630$

$57 - 160 = 9c$

$c = \frac{57-160}{9}$

$5 \overline{)790}$ (160) 158

$\frac{57}{9} - \frac{160}{9} = c$

$\frac{46}{4}$ 5

$57 - 160 = 9c$

$\frac{46}{4}$ 5

$57 - 160 = 414c$

$5 \overline{)574}$ (160) 125

$\frac{57}{9} - \frac{160}{9} = \frac{46}{9}$ 5

$\frac{414}{9}$

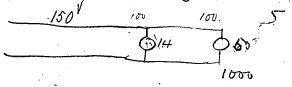
$5 \overline{)574}$ (160) 115 0 7

$-\frac{160}{9} = 9$) 162 (18

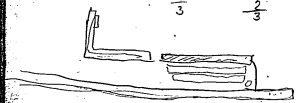
70

$-\frac{160}{9} = 46$

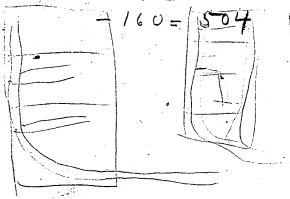
504



$\frac{1}{3}$ $\frac{2}{3}$



$-160 = 504$



$-\frac{160}{9} =$

46

32

178

135

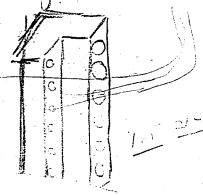
25

9 | $-160 = 9$

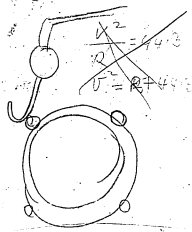
1

$\frac{5}{9}(7 = -32) =$

Pot. Ferricyanide 3 parts
citric of iron Ammon 5
H_2O 40



Pot. Ferricyanide 3 parts
ammon iron citrate 5
water 40
15 $\frac{12.5}{60}$ 62



$\frac{V^2}{R} = 440$

$V = R \times 440$

(12.5

100

$\frac{50}{2}$

400

$\frac{V^2}{R}$ 440 = 440

$\frac{V^2(440)}{R}$ = 440